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ORIGINAL COMMUNICATIONS.

THE RARE METALS AND THEIR POSSIBLE USE FOR DENTISTS.

A paper read before the Connecticut Valley Association, November, 1881, at Springfield, Mass.

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As you all know, there has been made a distinction between common elements and rare elements, for no other reason than convenience in teaching and studying. If we reflect that the so-called common elements number about twenty-five to thirty, that each element has at least five characteristic physical properties, that it forms at least ten binary compounds, that is, compounds by two with at least four distinct properties of each, that with each of the six or seven common acids it forms peculiar compounds, each of which is characterized by at least four distinct little facts, we see that the chemistry of the thirty most common elements is based upon the knowledge, the understanding and the distinction of at least three thousand little facts, and that a chemist of good standing probably knows some five thousand facts above them: you will understand

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why so seldom, even in good schools, the rare metals are made a subject of studies and experiments. Their scarcity, furthermore, makes experiments very expensive. Then, organic chemistry claims its share of a chemist's brains, and a great one too, for the formula of indigo alone would require the knowledge of six facts to be remembered safely; it can be said of the chemical element carbon, that its compounds alone occupy more space in the chemical literature than all the rest of the elements together. But this probably is due to the fact of their common occurrence in nature. There is no doubt to a chemist that there are few elements whose compounds would have to be numbered only by the hundred thousands; and if we take combinations only of constitutions as complicated as urea, without repetitions of the combinations, we obtain at least 48.000,000 compounds. As the number of compounds found so far, prepared pure and analyzed, is, taking a high estimate, about 20,000, you see that our science is boundless, and that we have only commenced to study it. Our chemistry of to-day is to the ideal not yet what the hollow tree-boat of the natives of Australia is to our ocean steamer.

I give these remarks, which perhaps might interest you from the point of view of pure knowledge, a point of view that I consider the highest imaginable, in comparison with which all illusions, air-castles and dreams, of all creeds together, are dust which a hurricane sweeps to and fro and drifts about in all directions, but also to show you that you have little scientific foundation to blame me, if I do not give you here a firework of new, dazzling facts about these rare elements, which to investigate, the pillars of the science, Berzelius, Klaproth, Bertholet, Davy, Guy Lussac, Liebig, Gladstone, etc., spent but little time and work, and which are still ready for investigation.

How relative the term rare is may be seen in comparing nitrogen and silver. Nitrogen forms four-fifths of our air, hence seems to be most common; silver seems to be rare, yet nitrogen being put on one pair of scales and all the silver on the other, nitrogen would weigh 9,000.000,000 tons, silver, 8,000.000,000 tons, on all the crust of the earth, figures of which we have no idea. Compared with this, gold is probably in the crust of our earth to the amount of not less than 8,000.000 tons, while platinum probably does not come up to one million tons. More rare are some other metals, like ruthenium and rhodium, which may not amount to 5.000 tons on the whole earth, and elements like thorium, or cerium, or lanthanium are probably not in quantities of more than 1,000 tons present, while all the chemical

establishments together do not possess ten pounds of each. Of elements as rare as these, we, therefore, can never expect any other but a scientific use.

I shall limit myself in what I have to say to elements that may be procured in useful quantities at a reasonable price. Dentists use metals and their compounds in different directions: for their tools, for metallic fillings, for plastic fillings, for tooth plates, and for physiological effects on the growth of the teeth. For tools, I do not expect that any metal will come into very general use among these rare metals, if not iridium, on account of its very great hardness can be used as the working point of small drills, just as it is used at present on gold pens to form the tips; the hardness of iridium is almost as great as that of emery; it cuts very easily hard steel; also small grinding wheels might be made of this material.

To understand the possible use of some of the elements in amalgams, I will give some facts as to their deportment with mercury: Antimony, as a powder, amalgamates easily and gives white and brittle amalgams. But the use of antimony in amalgams is very objectionable on account of its physiological effects. Cadmium forms easy combinations with mercury; they are crystalline, and heavier than pure mercury; the maximum is 78 mercury to 22 cadmium. It acts in amalgams physically similar to tin. Amalgams containing cadmium will turn yellow from a compound of oxide of cadmium with sulphide of cadmium; the sulphide is bright yellow; the oxy-sulphide has a paler color. If common amalgams, chiefly containing tin, silver, etc., are enacted upon in the mouth, generally insoluble compounds are obtained. Silver sulphurizes and forms insoluble SA_{g2}. Tin forms tin oxide, tin sulphide, tin hydrate, all of which are insoluble; different with cadmium, arsenic and zinc in amalgams; besides the mechanical difference, we have physiological effects from the solubility of the compounds formed; the least injurious effect is that of zinc, a slight local irritant which does not kill the tissue even in relatively strong solutions. Arsenic quickly kills the tissue with which it comes in contact; similar with cadmium, its action is between that of zinc and that of arsenic as it is also in some of its compounds; it is not quite as violent as arsenic, but enough to destroy in time the life of a tooth. The insoluble sulphide of cadmium probably does not form directly, but by decomposition of a previously formed either tartarate or hydrate or malate of cadmium with substances containing decomposing albuminous bodies, yielding sulphur

compounds. Nickel and cobalt can be brought into amalgams relatively easily; they show no useful peculiarities as far as known at present; the amount of nickel and cobalt that can be combined with mercury without any other metal is small, and the amalgam remains fluid, even with two to three per cent. of both metals. Their physiological effects are pretty neutral; large quantities of nickel can be taken without any other but the local effects of an irritant; cobalt is more violent in its action. Bismuthum combines very easily with mercury, the amalgam hardens very slowly and is soft.

When speaking about the physiological effects of certain substances, I have reason to complain about the vagueness of even good writers; e. g., about cadmium, I find a remark of a celebrated chemist—"It is poisonous." What a vague, unscientific term. What is "poisonous?" What does the term mean? Everything is poisonous and nothing is poisonous. Poisonous, like intoxicating, edible, etc., is one of the vast multitude of common life-terms with which, vague as they are in every direction, we only connect certain fanciful ideas. A steak given to a sick child may be as poisonous to that child as one grain of arsenic. One spoonful of alcohol is not intoxicating, and to call alcohol an intoxicating drink seems to me a sly trick by which people attribute to alcohol a property which belongs rather to the individual. That wicked alcohol—those good people! The individual does the intoxicating, not the alcohol; the alcohol is only the means, just as not the bullet shoots the person but the one who misuses the bullet. But back to our amalgams. We may expect improvement of quality of amalgams by the addition of some nickel or palladium or cobalt.

For plate and gum-work I suppose that too little have been tried the alloys of silver and gold with nickel; at least, compounds are known which are as fine a material and perhaps better than pure gold; compounds of gold with antimony are known, nine gold to one antimony, which have the whiteness of porcelain.

According to many experiments which I can confirm, as I once experimented considerably in that direction, antimony forms brittle alloys of no use at present, with copper, zinc, silver; besides, it is easily acted on even in the alloyed state by the acids in food and mouth; the alloys of copper and antimony have a violet color; those of antimony and zinc are as brittle as short dough or dried clay. I have to mention another element which, though it cannot be called rare, is rare in pure state, alumium. When first produced great hopes were based on its lightness, its fine color, its difficult oxydation

and the harmlessness of its compounds. Few of the hopes have been realized. The drawbacks are numerous; the price has been kept too high; still to-day alumium is quoted as high as silver; it costs so much to make it that it cannot be sold for less than it is at present. Its lightness comes little into play for gum-work, where it is loaded with blocks of teeth and gums; it is very difficult to solder. When I was a student at Prof. Liebig I learned a method of soldering alumium; as solder pure tin or an alloy of tin with a little silver is best; lead—which is in common solder—should be avoided because alumium will not take it; also zinc and copper are objectionable; as soldering liquid, syrupy phosphoric acid is best; it solders under these conditions, though with considerable difficulty. The resistance of alumium to dissolving fluids has been found not to be quite as great as at first supposed. If pure, it will resist pretty well, but if containing iron, it will dissolve more readily than any metal used in dentistry. Besides, the compounds formed are not quite as harmless as first supposed. Which compounds do form? If water, containing salt, be boiled with alumium, the water slowly is decomposed with disengagement of hydrogen and the formation of alumium-hydrate; the same process takes place in the cold, only more slowly still. Alumium hydrate is practically insoluble for itself in water, but soluble in tartaric, malic and acetic acid; we therefore obtain compounds of alumium with these organic acids which are always present abundantly in our food. At first all compounds act as astringents, that is, they cause the superficial fibers of protoplasma to contract, but if the administration of alumium be continued the effects are relaxation and soft swelling of the tissues, which can only be removed by the action of proper remedies. I therefore should not consider plates of pure alumium a very favorable introduction. Much better might work alloys of alumium, silver and tin.

Of some use might further prove compounds with wolframium—or Tungsten; it gives great hardness to the different alloys, and for certain purposes this might be useful.

There remains something to be said about the plastic fillings. No doubt, many combinations still await the practical dentist, which will prove useful one way or other, but the physiological effects of most of the rarer metals are too injurious to allow us to expect any great use of them; besides, they mostly form colored compounds. Only antimony, cadmium and bismuthum would form colorless or white masses, but the sulphur of decaying substances would stain bismuthum

compounds black, cadmium compounds yellow. There is no blackening from the sulphur from normal albumen, only decomposing albumen blackens silver, copper, lead, etc. Albumen contains a varying percentage of sulphur — Egg albumen, 1.6; Blood albumen, 1.2; Fibrine, 1.2; Muscle fibrin, 1.1; Caseine, 1.0; Legumine, .9; Caseine (almonds), .3; Emulsin, 1.2. The sulphur in these compounds, as long time as they are parts of living organisms, is not separable by the common weak reagents for sulphur or sulphuric acid or sulphuretted hydrogen; only when decomposition has set in, the sulphuretted hydrogen is disengaged. This is of importance in filling teeth. If we find under an amalgam-filling a heavy black deposit of sulphide, decomposition has been going on; if, on the contrary, the filling is only coated with a whitish or brownish layer, the tissue remained relatively healthy. A gold filling, of course, would not show this difference, since it forms no sulphides, but the processes described nevertheless go on.

In connection with considering the advantages of the rarer metals, it might be asked if perhaps there might be an agent among them to "bleach teeth." Bleaching is as such no chemical term. We might put the question: Are we able to destroy the coloration? What is it? That is to be answered first, ere we can go for it. But just here we meet with the most different views possible. From carbon down to sulphide of iron I have already read every view possible. The one who says in the Ohio Monthly that he considers the tooth a mass of lime with a little organic substance, regards it as pure carbon. With him we will not deal any longer. If the tooth is nothing but a mass of lime with a little organic substance, it will be very easy to study and make teeth. We first make them by drying a mixture of albumen and chalk and phosphate of lime and then let concentrated sulphuric acid act on it, and we have black decay. Concentrated hydrochloric acid produces white decay, etc.! Is it possible that in our century such crude—horribly crude—ideas can only be thought of. Because sulphuric acid blackens organic substances, these men suppose an acid like sulphuric acid acting in the tooth turning it black; because hydrochloric and sulphuric acids dissolve lime they are taken into the theories to account for the decay. Gentlemen, this is no science! A decaying tooth is to us, and to every thinking chemist, still an "I do not know." We do not know what dissolves the lime or why it dissolves only on this spot and not at others. The best we can do is to make a supposition as well supported as possible by the

best knowledge. First, the coloring of teeth comes from within; we need not suppose that blood corpuscles pass the capillaries of a tooth; the serum itself becomes colored under certain circumstances in contact with air. All attempts to bleach teeth must, therefore, strike the nutrition; we must bring back into circulation the colored deposited lime and connective tissue; but just in proportion as our knowledge of the cause grows, you will see that every attempt to bleach the tooth from without must fail. The best bleaching agent for very superficial action from without, without injuring the tooth, might be hydrogen peroxide, a rare substance, prepared only with difficulty, which cannot be kept for itself for any length of time. By treating a tooth from time to time with this substance it probably might be kept at an acceptable shade; it does not form an acid nor does it contain any; is entirely colorless and, in decomposing, produces nothing but water and with the carbon of tissues carbonic acid, deriving the carbon from organic substances it comes in contact with. But until we have found something which injected near the tooth into the tissue will alter the circulation so that the latter carries away the colored deposits, we cannot hope, radically, to cure coloration.

It might be asked further if there might not be found some anæsthetic which might act locally without affecting the whole system. It looks indeed rather coarse business, if we have to render insensible a whole living mass of 150 pounds weight, of millions of ganglia and nerve threads, simply to include into this general insensibility a small microscopic fiber ending at a small piece of inorganic substance. It is stopping a train to brush off a little stone from one of the wheels. With all local anæsthetics we have to consider the danger of destroying this small twig, and that is what limits our activity. Besides, the pain is probably at a point where we cannot reach the nerve. If we have caries, not the black parts in the cavity are painful, but the inflamed nerve at the narrow opening of the root sends the telegrams of his distress to the powerless brain — dead nerves do not tell stories as little as dead men. The best local anæsthetic is arsenic, but unfortunately its use is too dangerous to be recommended. Carbolic acid is too superficial, as are all these harmless compounds, Naboli, etc., strong alcohol. My personal conviction is that there will not be found so very soon a safe local anæsthetic for teeth. All the local anæsthetics on other parts, cold, electricity, etc., cannot be used with teeth because they are worse than the thing we want to remedy. The practical dentist alone can here decide what is best.

One has a good power of persuasion. He will talk that it does not hurt, until you believe it. The other tells white lies about the pleasing sensation of forceps, drills, and nerve needles, and when he is in your mouth it is too late to stop his "fiendishness." The best anæsthetics are time and self-control.

Perhaps the weakness of my paper in physiological facts will induce one or the other of you, who have more time and opportunity than I, to make experiments as to the physiological effects of some rare elements. I have no doubt that much good may be expected from compounds of Thorium, Thallium, Palladium, and many others in physiological directions.

A PECULIAR CASE OF INHERITED HEMORRHAGIC DIATHESIS.

BY DR. C. T. STOCKWELL, SPRINGFIELD, MASS.

Quite frequently, during the past seven or eight years, I have been called upon to perform dental operations for a gentleman of this city, who is the unfortunate subject of a hemorrhagic diathesis, so peculiar in its nature that a record of the same seems to be not unimportant. And among the many interesting facts connected with the case, that feature of it which demonstrates the persistent, tenacious force of inherited tendencies, is not the least. He is a descendant of a family whose history—much of it well known to me—shows a remarkable manifestation and transmission, by some of its members, of an anomalous physical organization, subjecting the person so constituted to an extreme *liability* to bleed profusely upon the occasion of even a very slight wound; a simple bruise, scratch, or biting of the tongue, has been known to be sufficient to originate a characteristic hemorrhage. Hence, they have been called, for many generations past, "Bleeders."

This phenomenon may be briefly described as follows: A cut, or other injury, be it simple or severe, assumes at first the common appearance. Soon, however, if inclined to bleed, a cone of coagulated blood gradually forms upon the rupture. This cone has a minute aperture, and is large or small, according to the severity of the wound. After a week or more, as the case may be, the blood begins and continues to flow from the aperture in the cone in a stream, perhaps, but usually more moderately, sometimes for several days in succession, until that fluid becomes nearly as colorless as water. At this stage, the sufferer of course assumes a most ghastly appearance, and is fre-

quently unable to raise a hand or even a finger. At least in two instances my patient has passed into a state of complete unconsciousness, the red corpuscles having become exhausted so that the slowly oozing hemorrhage would scarcely stain even the whitest cloth; and, strange enough, just at that critical point, the bleeding ceased, and he came rapidly back to life. He told me once that he "had died twice, and been resurrected." In one of these instances, the occasion of it was a simple rupture of the skin on the side of the neck, and the other a tongue-bite. In many other instances, more severe injuries have not reached such extremes.

The history of this man is the history of the whole race, and the nature, character and course of the phenomenon is common to all as far back as it can be traced. The bleeding ceases when the cone, which becomes very fetid, falls or sloughs off; a patient surviving this point usually recovers very rapidly. It has been found practically useless to attempt to stop the flow of blood at the cone. If one cone is removed, another forms. They also often bleed profusely at the nose. At least two physicians are now known to have belonged to this race of "Bleeders," both of whom died from excessive hemorrhage from trivial causes; and in no instance, of which I can learn, has this trouble seemed to yield to any treatment. About all that is attempted by way of treatment is to keep up the strength by highly nourishing and blood-making food, so that nature may be supported until she can slough off the cone, when the hemorrhage invariably ceases.

My patient is a sufferer from "Riggs'" disease of the gums, but what can I do? It was too far advanced, when he came into my hands, to accomplish anything without thorough work, and that I preferred to be excused from attempting under the circumstances. Consequently, his gums are gradually wasting away, and the teeth becoming loose and troublesome. For weeks and months I have seen one or more in a condition that they could be easily removed with the fingers alone; and, even then, in one case, when the tooth finally dropped from the gums, a cone (the sure precursor of bleeding) soon appeared and a hemorrhage followed, by which he was much exhausted and sorely troubled. In this case, the cone of coagulated blood nearly filled his mouth at times, rendering it almost impossible to take food. The fetor was also extremely offensive. I might cite many other instances that have occurred with this gentleman and his immediate progenitors, but as the description of one case illustrates all, except in degree, it would seem to be a work of supererogation.

There is, however, one other feature which must not be omitted, that shows the hereditary peculiarity of the phenomenon. It has been traced back through several generations to a single family in Ipswich, Mass., who introduced it here from England, and in all its history its course is the same. None but *males* are bleeders, and the sons of bleeders are *never* subject to it; but a bleeder's daughter's and sister's sons are extremely liable to be so predisposed. Bleeder's granddaughters' sons, on the mother's side, are also *liable* to be affected, but the number of progenitors, however, who thus resemble their grandfathers, is comparatively small. Bleeder's sons' sons are never troubled in this way. The descent is by the daughters and sisters of bleeders, and manifests itself only on the *male* side. It is said, furthermore, that those who are in that line of descent where they would be supposed to be *liable* to this malady, but are *not* bleeders, are found to manifest, instead, a predisposition to "quick consumption," or what is called "consumption of the blood." How uniformly true this may be, I am unable to say.

As far as I can learn, science and skill have been alike baffled in the elucidation and treatment of this strange phenomenon.

GOSSIP.

BY W. H. ROBINSON, D. D. S., OAKLAND, CAL.

"Young man, go West," is an admonition which has been quite generally obeyed. Yesterday we had a friendly call from Dr. Porter, of Toledo, O. "How do you like California?" we asked. Of course he liked California on general principles; everybody does. We have the best climate of the continent. Our next was "How about dentists in California?" His answer was, "You have more dentists to the population than any State in the Union, counting your 140,000 Chinamen who have no dentistry done." We think Dr. Porter was correct. California is the jumping-off place. When you touch the Pacific shore you cannot go farther West. The next place is China, and that is in the East. Our climate is salubrious, enjoyable, magnificent. Over about a third of our State there is nothing but climate, and those who try living there say a man does not get fat on climate alone. As a steady diet, pork and beans are better.

Well, as a result of our fine climate, people like to live here. Dentists and doctors like to live here. Consequently, we get our share of

those who could live in the East and two or three times our share of those whom ill health drives from the East. In one nice little town on our coast, with about 3,000 inhabitants, there are from seven to nine doctors who came there for climate. Now, these doctors are nice men, but they are human, and for a steady income must have something more tangible than climate, so they practice their profession. They cannot choose, like healthy men, a location that will give them the best business. Health is first. A thousand dollars a year and a climate that they can live in is preferred to a $5,000 practice in the frigid climate of the East. Here we have a clear contradiction of Darwin's pet axiom: "The survival of the fittest." We have the survival of the sickest in California, that is, the healthy, who can live anywhere, go where business is best, and the sick stay here. We are not finding fault with the unfortunate professional men of the East who are compelled to come here or die. We are glad so many of them can live here and do some business. But we want to say to the New England doctors and dentists, if you are healthy, stay where you are till you get rich, and then come to California. This is the best place outside of heaven for rich men. It is not the best for poor men. One thing is certain, M. D.s and D. D. S.s are greatly in excess of the needs of the population. In 1874 we were in Quincy, Illinois. It was a city with about the population of Oakland, and five to ten times the business. Quincy had six or seven dentists, Oakland has twenty-six or thirty, and at least one-third of the people of Oakland have their dentistry done in San Francisco. Allowing for those who cross the ferry to have their dentistry done, Oakland has one dentist to every 1,000 inhabitants. San Francisco has from 140 to 150 dentists. Omitting her Chinese population, who have no dentistry to speak of done, leaves one dentist to every 1,500 people. The majority of the voters in San Francisco are foreigners. Foreigners on an average have much less dentistry done than natives, and this is specially true of the *extremely foreign foreigners* that are so numerous in that city, and yet we are told the accessions of Eastern dentists to the fraternity of San Francisco average fifteen to twenty per year. What is true of these two cities is true of the whole State. S—— County, with no large city, and a population of 16,000, has ten to twelve dentists. We have no law in California restricting any one who chooses to practice dentistry, and just as fast as the Eastern States secure legislation that shuts out the frauds and quacks, they naturally seek a more congenial clime. California is not lacking in her

home supply of this class, but, alas! in addition to her home production, she has to receive a large supply that rigid laws or frigid climate drives from the East. We are a generous people here. California is the best state in the Union for a man to live in on twice his income.

Take the average genuine California dentist, and he is on a full par with those of any Eastern state. Gold has been more generally used here in filling than in the East, and California incisors and molars glisten and sparkle with gold restorations that exhibit the highest artistic taste and manipulative dexterity. We do not even bow to "*Bosting*" in cunning contours. There is a common impression in the East that dental fees are very high on this West coast. Of course, operators of established reputation in all large cities command almost any fee they choose. Then, of course, we have an abundance of that class that take any fee they can get; but, as far as we have data to guide us, we believe the charges of the first-class dentists of San Francisco are considerably below the fees of the same class of dentists in the big cities of the East. Through our rural towns the prices are considerably higher than in the East, and yet we have cheap Johns every where, who advertise fillings, fifty cents and upwards, and plates five dollars and upwards. We have plenty of room for all who come to California. We want to give the numerous M. D.s and D. D. S.s of the East this advice: Come to California—by all means, come. But stay a few years in the East and make some money before you come You can do it easier there than you can here.

"There was a man in the East
Too lazy to work, but he liked to feast;
So he concluded it would be best
To pack up his traps and go West,
Where he could so easily feather his nest.
But the trees of the West were not laden with gold,
And things were not as he had been told;
So he went East rather badly sold."

MORAL.

"There is no Western road to wealth and Heaven;
These only to those who earn them are given."

When a lady remarked to Dr. J. T. Codman the other day that she had heard teeth called "dew drops," it was of course just like him to reply that "they *do drop*, sometimes."

SELECTIONS AND ABSTRACTS.

THE DEVELOPMENT OF THE SENSES.

BY ROBERT W. LOVETT.

In the fifth century before Christ, Democritus declared that the senses of sight, hearing, smell, and taste were merely modifications of the sense of touch. Aristotle ridiculed his theory, and so, stamped with his disapproval, it lay untouched for two thousand years, until Telesius, an Italian of the sixteenth century, revived it.

Strange to say, all that modern science has accomplished in embryology and zoölogy tends to confirm this theory of Democritus, that these four senses are only specializations of the universal sense—the sense of touch. In the embryo of all animals the organs of these four senses first appear as infoldings of the outer germinal layer, the ectoderm, from which the outer skin also develops. At an early stage they are all simple pockets in the outer covering. If the history of the embryo is to be taken as the miniature of the history of the race—that is, if the individual in its development follows the same course that the race has followed, and it seems reasonable to suppose that this is the case—it is easy to see the importance of this evidence.

In the animal kingdom the sense of touch is universal; it is even found in those lowest animals, the protozoa, which are only masses of simple protoplasm. But, if this animal with its one sense is to become higher, there must be a division of labor; there is too much work for one sense to do properly, and by a quantitative modification this primitive sense is to become qualitatively different in parts, and this qualitative difference is the difference which we notice between the sense of touch and the other senses of the higher animals; it has come about by an accumulation of the sense of touch.

The waves of air which fall on the body of this protozoan as heat are capable of a higher rendering, they will signify more than heat to the proper organ for perceiving them, they will give the sensations of light and colors. The simplest eyes are merely pigment-spots in the skin, they merely distinguish heat from cold and light from darkness; but later, by the formation of a lens and sensitive membrane, the external world is revealed in all its variety.

The eye is first found in the sea-anemone, where it is merely one of these pigment-spots. But all that the most complete eye can give

to us is a field of gradated colors. In itself this field of colors conveys no information to us. It must be explained before it can be of any practical use to us, and this necessary explanation can only be furnished by our sense of touch. That is, distance, magnitude, and shape are not directly perceived by the eye, but are suggested by certain objective gradations of color which have been associated with them in our past experience. Thus, sight appears as entirely dependent upon touch for its usefulness. This theory was first advanced by Bishop Berkeley in his famous " Essay toward a New Theory of Vision," and was afterward confirmed in a very wonderful way by some experiments made by Dr. Cheselden, of London. A young man had been blind from his birth on account of cataracts. These were removed by Dr. Cheselden, and he suddenly received his sight. At first he could perceive no such thing as distance or form. Only by repeatedly touching objects could he bring himself to realize that certain experiences of touch were always associated with certain gradations of color. Gradually he connected the sensations of sight with the sensations of touch, and in time became as insensible as we are to their true relation.

The ear first appears, in the jelly-fish, as a pocket in the outer skin. In this simple condition it serves as a general indicator of violent air-motion. But as the animal becomes higher there is a demand for a nicer perception of sound, and this pocket is closed and finally is provided with a complicated acoustic apparatus, in the same way that the eye is provided with a lens, which renders into terms of noise and music those air-waves which to the rest of the skin are imperceptible.

But a sound conveys no more information in itself than does the field of colors presented by the eye ; only when we can tell from what it comes, and what consequences have been connected with it in our past experience, does it have any practical meaning to us. And, again, this explanation can only be furnished by our sense of touch, or by our sense of sight, which, as we have seen, is entirely dependent upon our sense of touch.

The senses of smell and taste should properly be resolved into one sense, for they are probably only late modifications of the same property of the mucous membrane lining the mouth and nose. This membrane is only an invading growth of the skin surrounding the mouth, so, morphologically, this sense is the same as the two just examined. The sense of smell is undoubtedly present in some insects, as, for instance, in the burying beetles, and may perhaps be found lower.

In man this double sense is undoubtedly retrogressive, and probably reaches its highest development in some of the lower mammalia. With us it is at best only a source of transitory pleasure, and seems in no way to contribute to our higher mental development.

But the senses of sight and hearing are very different in this respect. If Darwin is right, they have played a most important part in the evolution of the past as the instruments of sexual selection. And, in the future development of our race, it seems as if their perfection would be reached only with the perfection of the human mind. For if the impulse to development is given from without by the environment, these organs must be continually improved so as to perceive the nicer and nicer distinctions in the environment which will be the means of elevating the mind. If the impulse to development is given from within the mind, these sense-organs must be developed more highly in order to provide the enlarging mind with the continually nicer perception which it will require.

Man's mind develops, not his body. With the exception of these two sense-organs, his body has been nearly stationary for thousands of years, but these two organs respond to comparatively little change. The ear of the savage differs from the ear of the civilized man more than the two men differ in any other respect.

Touch, smell, and taste seem as complete as they need be for any conceivable human being, but that the eye is yet incomplete is very strikingly shown by the so-called actinic rays of the solar spectrum. In this spectrum there are rays beyond the violet which have an action on certain chemical substances much like the action of the blue and violet rays. But to the human eye these rays are absolutely invisible. The perception of this unknown color seems but a short step in the development of the eye.

But how different from the others, both in character and history, is the sense of touch! Having with them a common origin, like them it is resident in the outer skin, but it is active alike all over the body; the touch of the finger-tips may be more delicate than that of the palms, but it is only a quantitative difference. The sense of touch is the fundamental sense. All the other senses have to render their data into its terms before they can be understood by the mind. Animals can live without sight, hearing, taste, or smell, but the presence of the sense of touch seems a necessary condition of animal existence. The other senses are means of self-preservation; the sense of touch is the manifestation of an animal's existence.

The senses, then, all originate from the outer covering; this covering has from the beginning a special sensation from the resistance to external pressure; this property it retains throughout the animal kingdom. The other sense-organs appear as specialized parts of this universal sense-organ; morphologically they are only parts of the skin, rendered more sensitive than the normal skin.

All the evidence seems to point one way, to the conclusion that the other senses are all modifications of the sense of touch. That such is probably the fact seems to be generally admitted. What I have tried to show is our ground for that conclusion, and that what was with Democritus a random speculation is with us fast assuming the nature of a scientific truth.—*Popular Science Monthly.*

MALARIAL ORGANISMS.

M. A. Laveran has found in the blood of persons suffering from malarial poisoning parasitic organisms very definite in form and most remarkable in character; motionless, cylindrical curved bodies, transparent and of delicate outlines, curved at the extremities; transparent spherical forms provided with fine filaments in rapid movement, which he believes to be animalcules, and spherical or irregular bodies, which appeared to be the "cadaveric" stage of these, all marked with pigment granules. He also detected peculiar conditions in the blood itself. During the year that has passed since he first discovered these elements, M. Laveran has examined the blood in one hundred and ninety-two patients affected with various symptoms of malarial disease, and has found the organisms in one hundred and eighty of them, and he has convinced himself by numerous and repeated observations that they are not found in the blood of persons suffering from diseases that are not of malarial origin. In general, the parasitic bodies were found in the blood only at certain times—a little before and at the moment of accession of the fever, and they rapidly disappeared under the influence of a quinine treatment. The addition of a minute quantity of a dilute solution of sulphate of quinine to a drop of blood sufficed to destroy the organisms. Mr. Laveran believes that the absence of the organisms in most of the cases (only twelve in the whole one hundred and ninety-two) in which he failed to find them was due to the patients having undergone a course of quinine treatment.

—*Pop. Science Monthly.*

EDITORIAL.

Several things conspired to very severely try our patience in regard to the last number. In the first place there was an annoying delay in going to press after the matter was all in, with reference to which we tried to be philosophical and patient, knowing that the removal of a large printing-house is liable to be attended with some internal disturbance and upsetting of the best of calculations; but when the number finally came and we found the *binders* had played the *devil's pie* with the advertising pages, we about lost our grip on patience, at least in any *religious* sense. Had it not been so late in the month, we should have corrected this inexcusable blunder, even had it involved the reprint of the entire edition. Inasmuch as it does not affect the matter of *volume* binding, we finally decided to mail the edition as it is. But after hurrying them off, and having had time to look the number over more carefully, we are again disturbed to a still greater extent, if possible, by discovering a carelessness on the part of the proof-reader (ourselves) that is little less than exasperating.

When the June number is mailed, we trust this "Jumbo" of trinitarian "devils" will be found to have been cast out.

An item of interest, in the field of dental education, appears in the announcement that the University of Maryland has organized a *new dental department.* Prof. F. J. S. Gorgas, for twenty-five years connected with the Baltimore College of Dental Surgery, accepts the position of Dean in the new department; and Prof. Jas. H. Harris, also formerly connected with the Baltimore College, becomes Professor of Clinical Dentistry. The University of Maryland is one of the most venerable medical institutions in the country, and abundantly able to make the "new department" a success, which we trust it may do. All communications in reference to the above should be directed to the Dean, 259 N. Eutaw street, Baltimore, Md.

After being compelled for so long a time to notice in the various public journals, from all parts of the country, the frequent flippant and senseless references to the dental profession, it is refreshing to find now and then an article whose writer seems to possess an approximate

conception of the true status and scope of modern dentistry, or that part of it which represents the progressive and scientific side of the profession that is so rapidly coming to the front. The latest that has come to our notice is an editorial in the May number of *The Paper World*, entitled "American Dental Journalism," and is so good that we copy a portion, omitting much that may be of too personal a nature to ourselves and others. It may be found in another part of this number.

We are sincerely pained to learn that Dr. J. L. Williams, of North Vassalboro, Maine, has quite recently been sorely afflicted by the loss of his wife. The precise date, or circumstances connected with her death we are unable to state, but infer that it was sudden and unlooked for. We are sure that all who *personally* know Dr. Williams, and none the less those who only know him through his able and interesting investigations in the field of histology, as reported in the dental magazines of late, will be deeply sincere in their condolence. Conscious as we are of the fact that the most profound sympathy cannot make good the loss, still, next to the *memory* of the departed, we believe it to be the most helpful in bearing it; and the JOURNAL wishes to join those who offer it in full measure.

RAMBLINGS AMONG THE JOURNALS.

The first article of the *Independent Practitioner*, for March, 1882, is a clinical lecture of Jas. T. Whitaker, M. D., on a case of facial paralysis. For students of the effects of nerve lesions and by conclusion, as to the function of nerves, nothing is better than an exact report of such cases. The case has nothing particular in itself; it is one of rather common paralysis of the so-called portiamollis of the seventh nerve of Bell or the facial nerve, as it is termed now, but it is treated very interestingly.

According to an extract from the Lancet (London), they use in London hospitals *artificial* Hunyadi Janos water. "It will be found to possess every advantage attributed to the natural variety," says the Lancet (London). How does that agree with the view of those clamorers who suppose that the solution of Glauber and Epsom-salts, as it flows from the soil at a Hungarian town, is quite different from the same solution made at any other place, only minus the peculiar labeling and the peculiar bottles?

The editor sees danger ahead in the formation of anti-vivisection societies in America. The anti-vivisection legislation is one of the greatest aberrations to which impressive females may induce masculine (?) legislators. Against cruelty, all states have sufficient laws, but to block scientific investigation for the sake of a few weak-minded males and females who, in their ignorant clamoring, too easily find applause from ignorant masses, would mean to go back one step into mediæval fanaticism, only in other directions. About the value of vivisection there can be no dispute among competent people with sound minds. To exclude vivisection for the physician is the same as to forbid a mechanic to practice filing on a piece of iron, or for a chemist to evaporate several times a solution of alum, in order to get good crystals. Think of that cruelty against the poor alum, to be heated and evaporated several times, only for the sake of getting crystals which one might just as well buy. There is no religious, no rational foundation to the anti-vivisection movement, only the defective logic of the lady secretary of the club in England, together with "society influences," —that is the influences of an ignorant mass of well-dressed, rich, sentimental fops, with immense assumptions,— are the scientific (?) foundations of this craze.

The *Dental Cosmos* of April, 1882, opens with a continuation of an article by J. Foster Flagg, D.D. S., on dental pathology and therapeutics; "entered according to act of Congress, etc., by J. Foster Flagg, in the office of the Librarian of Congress at Washington." What is entered? The article, or the title, or the Dental Cosmos, or Prof. Flagg himself? In either case, in copying the title, we do not intend any harm and wish to remain unmolested from legal proceedings. We hardly dare criticise on account of that act of Congress. The paper is on replantation in its detailed aspects and is very good in its practical points. We possess Dr. Flagg's quiz-questions and we looked to them for explanation of the "basal attributes" and "controlling attributes," the names sounding to us so very Hindoo. All we find is on page 93, where some fine words for spelling matches are found, but no explanation of what we were looking for. What is "bilious positivity"? Biliousness? Every dictionary accessible to us gives out; there is a number of similar empty words without exact meaning in the article; but the fact that we do not agree in minor points ought not to produce the impression that we do not consider the paper very good.

The second paper is on the assimilation of Inorganic Particles and the Topical Action of Mineral Waters, by James Truman, D. D. S. Most heartily we shake hands with the author on the grounds of the evolu-

tion theory. The terms "coarse" and "gross," used of flora and fauna, are so completely arbitrary and undefinable that we should hesitate exceedingly using them in a scientific essay or paper. There is no more coarseness in an alga than there is in a flower; no more coarseness in an amœba than in the human brain; those terms are made from a stand-point of simple and pure vagueness. A marsupialian animal is in no way "coarser" organized than a cat or a dog. On the point of assimilation of inorganic compounds there might be some doubt, and very grave doubt. To get over the difficulty of the assimilation of lime-salts by hens, the author simply gives us the authoritative statement: "The shells of eggs cannot be held in any sense as organized products." Why, what then? Please to make egg shells, *identical* with those of eggs, in the laboratory. If the author will do that, all right. Close them properly,—get the pores and all that of egg shells, and then we will believe him, but an egg shell is just as much organized as the animal. Again and again "vitality" in all its vagueness appears, while it would be far better to speak what exact action of "vitality" comes into play, instead of a cheap "lack of vitality." The article closes: "An inference to be arrived at from the examinations there given, is that there is no local destructive action by the ordinary waters that are found upon the earth's surface." Such a sentence ought not to be stated in such a general way by a scientist of Dr. Truman's standing. What are "ordinary waters?" Every water is ordinary, and no water is ordinary; every water is peculiar in its composition, and not ordinary. There is the Rio Vinagre, in South America, the Tuscarora water and some springs at Alabama, Genesee County, N. Y., which contain respectively 2-4 p. c. of sulphuric acid. They are just as well "ordinary waters" as the Karlsbad and Ems waters, yet this general statement will not hold good of these waters. Better perhaps would it have been to say that waters of neutral or decided alkaline reaction have no local destructive action.

In an article on the Value of the Dental Pulp, at Different Periods of the Life, by D.D. Smith, D.D.S., M.D., the author makes the following statement: "With the extirpation or death of the pulp not only is all sensation in dentine and enamel at an end, but all vital change." "While it is improper to speak of a pulpless tooth as a 'dead tooth,' it is certainly not inaccurate to characterize the enamel and dentine of such a tooth as 'lifeless or dead.'" The pulp is dead, the enamel is dead, the dentine is dead, and remains only the pericementum to prevent the tooth from being called dead. Is not that what the author means?

In the meeting of the New York Odontological Society, December 20, 1881, the spicules of bones found in the sockets of teeth, and their troubles, formed a chief topic of discussion. The cases where they occur are not many; the symptoms are very dark, in every case the pain was unbearable, and the only relief was extracting an apparently sound tooth.

OPERATING TABLE AND LABORATORY.

During the discussion of the question of "Transplanting and Replanting Teeth," at the late semi-annual meeting of the Merrimack Valley Dental Society, Dr. T. Palmer, of Fitchburg, Mass., related the following: While he was a small boy his father suffered the loss of a tooth—an upper incisor. After returning home and viewing his misfortune by means of a glass, the expression of his face indicated that he did not enjoy the disfigurement. He, however, being a native Yankee, proceeded to carefully study the extracted member and the socket from which it came. Soon he started for the "wood-pile" and selected a piece of pine wood that very closely resembled the tooth removed in color, carefully shaped it so that it exactly compared with the tooth, and again presented himself before the glass and proceeded to press the wooden tooth into position. Finding it a little too long, he withdrew the same and shortened, after which he reinserted firmly, where it did good service for four years. The Dr. says that it was in watching this operation that he first received an impulse to become a dentist.

TRANSPLANTING AND REPLANTING TEETH.

Those having occasion to replant or transplant teeth will find an "item of interest" in regard to retaining them in place by turning to pages 170 and 171 of the Cosmos (current number). In our estimation, it is as absolutely essential that replanted or transplanted teeth should be ligated or in *some way* retained for a suitable length of time in an *immovable* condition, as a broken bone. A tooth so large as to need a mallet to "*send it home*" does not by that treatment take any more kindly to its new relations. In such a case absorption is absolutely sure to take place and the tooth expelled. Understand protoplasma, and then learn to guard and protect it, if you would gain success in this direction.

CHICAGO, May 3, 1882.

Editors of New England Journal of Dentistry:

I notice in the April number some remarks in relation to lining rubber plates with metal. Your correspondent, "E," is correct in saying, "more humbug than common sense." The metal conveys the heat only to the rubber, and there it stops, and the heating process and inflamed membrane still remain. I have found that the process of absorption goes on beneath the rubber attachments of a gold plate the same as though the plate were rubber. The only advantage of the gold is that the heat is not retained over the palate. Any person who can afford metal plates ought to wear them in preference to rubber on the score of healthfulness, cleanliness and comfort, *provided*, of course, the dentist knows how to properly make and adjust the metal plate to the mouth. L. P. HASKELL.

We wish to add a few words to what we said in the last number in commendation of the "Sand-paper Disks." The continued use of this appliance adds to our appreciation of it. Dr. Meriam called attention to an improvement in the matter of "cutters," by Dr. Stevens of Lynn. We have in our possession one of the Stevens Cutters and find it to be all that can be desired. All that any one needs in order to supply himself with these very great helps at the operating table is to procure a cutter, prepare his paper or crocus cloth, and "punch" them out by the hundred. A few minutes' work will supply you for a month at an expense not exceeding two cents per hundred. The Stevens Cutters are made of the best of steel and of four sizes—three of them corresponding with the three smallest sizes of Dr. Meriam's, as illustrated in our last number; the fourth being still smaller, one-half inch in diameter, which is a very convenient size in many cases.

The machinist who makes the cutters for Dr. S. has the dies for forging and tools for milling them, and should any one wish to order them rather than get them made himself, he can send one dollar and five cents to Dr. S. G. Stevens, Lynn, Mass., who will send one all ready for use.

Two sheets of crocus cloth should be glued together, cutting sides out, in order to make a disk stiff enough to be of service. One side may be shellac varnished if desired. Large disks may be easily made smaller by placing them in the mandrel, revolving at a high rate of speed, and by means of a sharp instrument reduce in size somewhat as a wood-turner would proceed with a block of wood. By this means one cutter will answer all purposes.

A dentist was once called upon to treat an abscessed bicuspid, but after frequently pumping in carbolic acid for a month or more, and the discharge, if anything, increasing, was led in sheer despair to fill root and crown—whether with "brains" or not, we cannot say. However, the abscess speedily subsided. What was the condition, and why did cure result? OSCAR.

Evidently the case cited is one of the many "too much treated," and whatever the tooth was *filled* with, "*brains*" did not enter largely into the *treatment.* There may have been a discharge of pus at the beginning, but at the close it was pure *protoplasm.* Nature was doing all she could to make repairs, and won the victory only by manifesting unusual persistence.

Dr. Atkinson has preached many a sermon on this subject, and doubtless many a time been grieved by the dullness of his hearers; but, we believe, some have heard and treasured up his teachings, and cheering results are being manifested. The study of histology and the use of the microscope are the avenues through which a correct knowledge of these cases are obtained, as well as the method of their scientific treatment.

Carbolic acid is excellent in its proper place, but it is not always indicated, and when this is a question, mild dressings may be resorted to till it is certain that a more powerful mendicament is required. Dr. Flagg used to say to his class, "when you don't know what to do, do nothing," and it cannot be denied that this is good advice; but it is much better to know what to do and go ahead, the *master* rather than the *slave* of circumstances.

PIVOT CROWNS.

The great variety of cases and conditions met with in the practice of dentistry make it necessary for the operator to be well up in methods, if he would serve his patients worthily—not one base plate for every set of teeth, not one kind of filling for all decayed teeth, or one method of attaching crowns to the roots of teeth, but each in its proper place. For the last-named, there have been various methods described of late, and all very likely have some merit. There is, however, a method employed by a few of the old operators which has the merit of having been proved successful, and is especially appli-

cable in those cases where the root to be operated upon stands more or less out of position.

Prepare the end of the root as usual. If the canal is quite small, enlarge it only to the size of the gold or other wire desired for the pivot. Fit over the end of the root, by burnishing and trimming, a cap of platina or pure gold; punch a hole for the pivot over the hole in the root, and solder pivot in place. With this in position, grind the (plate tooth) crown to place (of course it can be placed in any position necessary, and this is one great advantage of this method), retain with wax or by other means, remove, imbed in plaster and sand, and solder. Next enlarge the opening in the root to about the size of that in an ordinary pivot crown; drill a hole in a piece of ivory or bone (an old tooth-brush handle will answer) the least possible smaller than that in the root; make a hard wood peg of such a size that it will be somewhat condensed on forcing it into the hole in the ivory; cut off each end smooth with the ivory and drill through the *center* of the peg a hole of such size that the gold pivot will enter with comparative ease. This *bush* is to be removed and placed in the root, the gold pivot barbed and forced to place.

If the root canal is much enlarged, prepare thoroughly and fill with amalgam, using a portion of the tapering end of a common needle for a center hole. Remove the needle at once, and when the amalgam is hard, proceed as with a perfect root.

Hide your fillings. Don't let them proclaim to the world "this tooth was sick, rotten, neglected; but now it is filled." Gold fillings stare at one with a keener gaze than others. Incisor and canines can often be filled from the palatine surfaces, and thus secure modesty.

H. S. C.

To Keep the Spittoon Odorless.—"Two or three little cups" to spit in, tumblers for washes, and to drink from, all in use and in a row "on the top of the cabinet," may be "far more convenient and wholesome" for the use of some dentists than a properly cared for concealed bowl beneath a glass funnel. But the paragraph suggesting that a few crystals of potash thrown into this bowl would insure sweetness while in use was written for the express benefit of those who believe that "cleanliness is godliness," and that uncleanliness to the eye is as offensive to decency as impure odors are to the nose. R.

SOCIETIES.

BROOKLYN DENTAL SOCIETY.

Regular Monthly Meeting May 8th, 1882.

LECTURE BY DR. CARL HEITZMANN, ON THE MOST RECENT DISCOVERIES IN THE MINUTE ANATOMY OF THE TEETH.

Mr. President and Gentlemen of the Brooklyn Dental Society:

The Bible tells us that many thousand years ago the Lord built Adam from mud, and that after this was done he took a rib in order to form Eve. If we consider the difficulty to make a model of the human form, especially to carve such a large number of teeth, before life was blown into them, we must conclude that to-day, somehow or other, the work is done in a very much easier way. You know that it is pretty difficult to manufacture a set of teeth artificially, but to make a real, live set of teeth, is quite a different process. You know that two parties and two parts come together—the ovum of the female, so small that it hardly is to be seen with the naked eye, and the spermatozoids of the male, which are not visible to the naked eye, but perceptible with a magnifying power of the microscope of 500 diameters. From the moment these parts commingle, a new individual starts, full of wonders and with an organism complicated beyond description. Think of it! One part is destined to produce muscles, another part builds up the frame or skeleton, a third part produces the organs of the nervous system, and last, but not least, the teeth, with all their wonderful complexity of detail. The Lord blew life into them many thousands of years ago, they say, and it took us several thousand years to find out where the life of a tooth is located. The work of the last four or five years has enabled us to tell positively that the teeth are really alive, and it is the purpose of my lecture this evening to tell you something about the seat of life in the teeth. First let us consider what we call life as such. New life begins with a little churning, as Dr. Atkinson has called it, in the ovum soon after it is impregnated—a movement in the germ fructified under the influence of the spermatozoids, which we do not understand at all; and soon afterward, in the first twenty-four hours, enormous numbers of small corpuscles have arisen from the original ovum. These corpuscles, which we call indifferent corpuscles, form the medullary or embryonal tissue, and this is the very tissue from which all the tissues of the body arise. The

result is quite respectable indeed. The baby new born is an admirable little thing; but that baby grows for say twenty years, and reaches the height and bulk of my body, or still taller, perhaps to the size of Jumbo, for he is produced in the same manner. In this way life is blown into the organism. But *why?* is the first question; and is it a blessing that the Lord blew life into us? is the second question. The why is no question to decide at all; we are but too happy if we can tell the how. The why will perhaps be answered after a number of years, when we know exactly the how, but it must be omitted from consideration for the present. We admire the complex condition of an organism of living matter. It is a division of labor which leads to the development of the muscles, the skeleton, the teeth and other organs; but why all that is done, we canot say. The aim of life is just as great a puzzle. What for do we live? Why are we in the world? You cannot find two persons who will give you exactly the same answer to that simple question. I once asked a beautiful lady: Why are you in the world? She looked at me thunder-struck, and thought it was a very rude question. But if you go to the bottom of things, perhaps one says, to worship God, to pray, to sing hymns; another, the Yankee, says we are here to make money and fill our pockets; a third has another idea: Enjoy life, he says, eat and drink and have pleasure. The fourth will say: No, there is some aim for life, and it is to search for the truth, to dig in order to get a little particle of truth from that immense and complex mass called nature, and find out something that will stand proved to our senses; this is an aim for your life, and if you do this you will not live entirely in vain. This latter opinion is mine. As to the second question, whether life is blessing, I must, I am sorry for it, deny that it is. Living matter has a capacity of growing and reproducing its own kind, and this law is compulsory to every one. So long as we grow, we build up our bodies; but as quick as we have reached a certain bulk, as soon as we have stopped growing, there comes an impulse to marry and produce children. We must admit, however, that there is no blessing in life at all, for it is a chain of sufferings from birth to the end. If you think of the teeth alone, what a large amount of suffering they bring us, and these are perhaps the least sensitive portions of the body. Think of the diseases, the weaknesses, the sorrows and cares of that little life, which lasts in the best case say eighty or ninety years. But let it last for 200 years, which is the case with the elephant, and still we must admit that this is a short time, if compared with eternity. The teeth especially give rise to a number of

sufferings, and fortunately for you, because they keep you busy, and you live on that suffering. Were there no teeth, and especially no nerves, you would not earn bread and butter. But it is a wise arrangement in nature that the sufferings find their remedies; and in this respect dental work especially is a most successful department of medicine. I am very fond of dental work,—provided it is done on somebody else! I am very fond of the investigation of the teeth. By this digging for truth, we of course gain a certain amount of knowledge as to the foundation of our medical work; and then we can say that there will be progression in medical work. A kind of reasoning must result, and medical interference will cease to be strictly empirical. Instead of being rough and mechanical work, it will gain scientific foundation, and for this we work, for this we strive.

The medullary or embryonal corpuscles that I mentioned before, are the very formers of the body. They are little marvels indeed. We know by comparison of facts in different organisms that there is not only similarity but identity, in the strictest sense, in all the organisms throughout the animal and vegetable kingdoms. We know that the lowest animalcule, the amoeba, such as we find in a little drop of puddle-water, is built up by the same substance as the most complicated and highest developed human being. In 1835, Mr. Dujardin, of Paris, first discovered that peculiar jelly-like mass for which he proposed the name sarcode, from the Greek word "sarx," meaning flesh; and "eidos"—like. This word would have been a good one, indeed, if Mr. Dujardin would have recognized the identity of the sarcode throughout the animal kingdom. But unfortunately he was far from such knowledge. Much later, in 1861, Max Schultze, of Bonn, in Germany, first announced that the matter which builds up infusion animalcules and that building up the human frame, as well as all the animals between these two extremes, is one and the same thing. It is, in the widest sense of word, the *living matter*, and for it he proposed the term protoplasm—"proto" being the Greek word for *first*, and "plasma" the formed. The word did not originate with Max Schultze; it was first taken into our nomenclature by a botanist, Hugo Von Mohl; but Max Schultze was the first to propose it for the designation of the material composing animals in general. Meanwhile Schleiden, in 1837, and Theodor Schwann, in 1839, announced that there was an ultimate element in the construction of vegetable and animal organisms, and for this they proposed the term *cell*. The word cell was taken up especially by the German microscopists. The word protoplasm means living matter,

and the word cell means the ultimate element or unit of living matter, therefore the definition was, according to Max Schultze, that the cell was a lump of protoplasm, protoplasm meaning something endowed with life in general. Max Schultze said that the nucleus that we find in the so-called cell is something essential to it; and he added that the granules likewise belong to the structure of the cell. In the same year, 1861, he was contradicted by critical men, such as Ernest Brucke, who said they knew of many lumps of protoplasm or cells which did not exhibit a nucleus. As to the granules, he said perhaps they are taken in from without; perhaps they are secondary formations, and did not belong in the schema of the cell. Gradually the idea developed in the minds of German histologists that protoplasm, or living matter, was devoid of structure. If you read the book of Stricker on histology, issued in this country in 1872, you will find this definition of the cell: "A structureless mass of protoplasm." This condition of things you will admit was not very satisfactory. In the first place, we all realize that a thing destitute of structure could not exist; and, in the second place, there was no proof at all at that time that the granules were really extraneous. When I took up the study of protoplasm in 1872, I had before me a blank book. A structureless mass is a very unsatisfactory definition to be sure; and what I was after was just to find out whether this protoplasm was really structureless. The results of my researches were contrary to the assertions of histologists at that time; it was proved that what they called protoplasm, was a very complicated organism. A lump so minute that it is only perceptible with a power of 500, if magnified up to 1000, displays a marvelously complicated structure, which essentially can be designated to be reticular in nature. The reticulum I announced to be the living matter proper. This in its first appearance is a granule and is homogeneous, viz: with our present means of observation we cannot discover any structure in it. The granule grows, takes in liquid from without, and is supplied with small cavities scattered throughout its mass, the so-called vacuoles. At a further stage of development the walls of the vacuoles break down and a reticular structure is established throughout the lump of living matter. I proved that the nucleus, connected with the reticulum, and the investing continuous layer, are also formations of living matter. The reticulum contains a liquid destitute of life. When we take a broader ground we can say that everything is alive, as is water, too, but from the biological standpoint it is better to say that liquids are not endowed with the properties of life.

Now, as a new discovery was started as regards the structure of protoplasm, the question arose: Are not all the parts of the animal body reticular in structure too? By carrying my researches through all parts and tissues, I came to the conviction that in fact this reticular structure is present throughout all the tissues constituting the body. It is this particular structure that has been proved to be present in the teeth, and this reticulum is the seat of life. We know that it contains all the properties and characteristics of living matter, and we know, therefore, from its shape, that it is alive even if we cannot see its motion, change of shape and place. Whenever we see this living matter which is characterized by a number of appearances when subjected to certain limited chemical agents, we can say: Here we have to deal with living matter, that is, with matter which will react upon irritation, and grow and reproduce its own kind upon being irritated.

The reticular structure of protoplasm was discovered in 1872, and was publicly announced to be present by myself in 1873. I was not the first to claim that such reticular structure does exist. Before me, it has been seen by several investigators, though none of them had found it to be a universal law and recognized its value and its meaning. Toward the end of 1874, when I left the old country, one of the first things I took hold of here were micro-photographs, made in Washington by J. J. Woodward. They were not produced with a very high power, but with very strong oxy-calcium light. In these photographs we can see the reticulum with the naked eye, but still better if a little magnified. Since that time the recticular structure of so-called protoplasm has been acknowledged by the very best microscopists abroad. I have demonstrated it to a large number of attendants at my laboratory in New York, still there are people who not only cannot see this reticulum, but doubt its existence. Dr. Lester Curtis, of Chicago, was very anxious to see the reticulum in protoplasm; he wrote me two letters asking my advice, nevertheless he failed to see it. Lester Curtis, instead of keeping still, published an article in the transactions of the American Microscopic Society, in which he states that he is unable to see the reticulum and that he did not meet with a man who has seen it. A positive statement, as you know, is to be published and made known to the scientific world; but a negative statement should be retained, provided that the positive statement is made by trustworthy men. You know that microscopy is a difficult art. I am a draughtsman, my eye was educated by drawing all the time, and by such an education of the eye I was enabled to see what is to be seen.

And what I announced was proved by a number of good observers. Last week I had a letter from Buffalo, from Dr. Barrett, asking me to tell him how to do the work in order to see the reticulum. He alludes to Lester Curtis' article, and tells me that he put the lens so, and so, trying to see the reticulum. He kindly writes that once in a while it occurred to him that he could see it, but his friend opposed the idea and he gave it up. I replied: Dear Doctor, you will admit that it is very unpleasant work to me to keep stating that the reticulum is visible; and if you think of the fact that it is acknowledged by the best microscopists to be easily visible, I think you must admit that the fault is either in your lens or in your eye. In the first place, good lenses are rare. I have tested a large number of lenses from the best manufacturers in the world—French, German and American, and I very often have to refuse immersion lenses.

The second blunder is that the eyes are not sufficiently educated. If I hand a violin to a gentleman who never played a tune and ask him to play, he will certainly politely refuse; but will he write an article on that and tell the public that he tried to play a tune on the violin and could not do it? If he is in earnest, he will take lessons a few months or years, and then he will be fit to play a tune. It is the same with the microscope. At first you are perfectly at a loss. It is a difficult art to learn to see; but still I maintain that this reticulum is easily seen, without the least difficulty, if you are led by a teacher, who tells all the little improvements in method, all dodges and kinks. One of the great geniuses of this country, Dr. Dio Lewis, of Boston, worked in my laboratory for three months. After a few weeks I was anxious to teach him all these little things in the structure of protoplasm and I showed him how to look. He jumped up and said: "I can see the reticulum with my hands tied behind me; I don't understand why people cannot see it."

Prof. S. Stricker, one of the most careful of men, my tutor in 1873, hesitated to accept the existence of the reticulum, but he advocates it now himself, and recently describes it in saliva-corpuscles. Of course I cannot ask everybody to come to my laboratory and look at it. I might go wherever there are gatherings of microscopists and histologists and show it to them; but I am afraid such demonstrations cannot be made in a haste. It takes a preliminary education of the eye before the eye is ready to see the reticulum. The trouble is that most people look a little through a lens and then imagine that they are prepared to see all there is to be seen. I must insist upon the educa-

tion of the eye as the first thing necessary, and I repeat that the moment the eye is prepared to see, it will do so without difficulty. This reticular structure is present in the teeth, and with all that I have said so far, I think we are ready to enter upon the discoveries which I am a little proud to say have started from my laboratory.

When I came over here, seven and-a-half years ago, I said to myself: You go to America, take your family along and establish a scientific laboratory and try to instruct physicians there; in short, try to raise the standard of medicine. A few friends I had here, laughed at my idea and took me for an idealist; you may try, they said, but you will fail sure. I knew very well, gentlemen, that would I have come with mere ideas, suggestions, hypotheses, dreams, I would have been a lost man. You Americans do not care much for fancies, I am sure, and justly too; but I knew that if I brought facts and could show them, I must prosper. And the result was beyond my expectations—surprising indeed. The first two years my laboratory was not sufficiently known, and the success was not very great. From the third year, my laboratory was an enormous success. I started with four tables and four microscopes, and to-day I dispose of seventeen tables and seventeen microscopes, which nearly all the year round are occupied. Why have I succeeded? Simply because I could convince honest men of the truth of my discoveries. I know that from the moment that only two or three dozen honest people are convinced of the truthfulness of my assertions, I cannot be a lost man any more. My work must grow because a number of earnest men are convinced that here is real truth to be found.

One of the earliest attendants at my laboratory was Dr. Boedecker, of New York. He asked me how to prepare specimens for microscopic research, and he brought me some of his old specimens of teeth ground in the old-fashioned manner. I told the doctor that he would never succeed with such kind of material. I said to him: If you are anxious to see the frame of a tooth, it is well enough to grind the dry tooth for examination, but if you are anxious to find something better than that, the seat of life and the living matter within the teeth, then you must resort to entirely different methods. You must place the teeth in a solution of chromic acid, then cut a thin section with a razor and study the features under the microscope. Dr. Boedecker carried on this investigation for several years, in spite of his busy practical work. Shortly after Dr. Boedecker commenced his studies, Dr. Abbott came, and almost simultaneously the good angels brought Dr. Atkinson to my laboratory.

What we have found I propose now briefly to explain. The main tissue in the teeth is the dentine. This dentine is, as has a long time been known, pierced by canaliculi, which run in a regular direction and were for a long time known to contain very delicate *fibrillæ*. You know very well that work upon the dentine is by no means painless, and that when caries invades it the pain, though not very intense, is present, especially upon change of temperature. This and a number of other facts are indicative that the dentine is endowed with life. Facts known for over a hundred years strongly point in favor of this idea. I allude especially to the researches made by the great German philosopher, Goethe, who studied the teeth of elephants—which are materially identical with human teeth—into which bullets had been driven. You know that the elephant hunter's target is the socket of the eye, that being the only place through which a ball can penetrate. This target is often missed and the ball sometimes lodges in the tusk and remains there embedded for years, producing quite a revolution in the dentinal structure, which is not fully explained. A reaction is established where the ball has penetrated, which is a sufficient proof of the life of the dentine. Dr. Boedecker discovered that the fibrillæ piercing the dentine in the canaliculi are living matter. Projections of delicate offshoots into the walls of the dentinal canaliculi were demonstrated, and a reticular structure throughout the dentine, which is an indication that the living matter pervades the whole dentine, and that not only the fibrillæ seen in the canaliculi are forms of living matter, but also the offshoots which connect them through the basis-substance. A direct proof has not yet been obtained of this. The process of caries provides an almost absolute proof of the presence of the reticulum throughout the dentine; but an indirect and secondary proof is of little value. We would better not assert a fact upon that evidence alone. These facts are left to be established when we shall have more perfect lenses, with a stronger power than glass. Dentine, therefore, so far as we can see, is pervaded by living matter within the canaliculi.

The second tissue of great importance to the teeth is the enamel which covers the crown. Formerly enamel was considered, by even the best dentists, as being simply a crystal or a piece of marble, in spite of the fact that even this enamel showed symptoms of life. I omit to mention the reaction upon caries, which could not occur had the enamel no life. But if you bite into a sour apple, or eat a sour orange, your teeth will react upon the acid. It is in vain to assert

that the acid destroys a little of the enamel and so reaches the life beneath. If small particles of the enamel were destroyed every time you eat an apple or an orange, there would soon be none left at all. Another explanation is that the acid irritates some part of the enamel, and this irritation is carried down to the nerves, and that makes the teeth stand on edge. Now Boedecker was the first to discover the seat of life in the enamel. All the delicate fibrillae that penetrate into the enamel are formations of living matter, the so-called enamel fibres; the whole enamel is pervaded by the delicate reticulum, which is probably living matter also. But this is not yet demonstrated. From the moment the enamel was proved to be endowed with life, it was made a tissue. A connection is established between the dentine and the enamel in several ways. In the first place, you notice that the boundary line of the dentine toward the enamel is not even, but is supplied with excavations, in which we find formations of living matter more numerous than in the dentine or in the enamel. This layer was proposed to be termed the interzonal layer by Dr. Atkinson. The living matter appears in the shape of a net-like arrangement, or in that of hooks, being evidently destined for the connection of the dentinal with enamel fibres. In many places the dentinal fibrillae are not directly connected with those of the enamel, but there is a reticular structure between the two, from which gradually emerge the enamel fibrils. Dr. Tomes, of London, who is, of course, anxious to see all that we describe in America, wrote Dr. Boedecker a letter saying that he could see everything except the enamel fibrillae, which are in fact not easy to see. It took me quite a while to be positive of their presence. But we have a means of making them plainly visible. Look in the first formed enamel cap of a human fetus of seven to nine months, and there you will see the enamel fibrillae very well indeed.

The third tissue which became plain in its minute features, was the structure that surrounds the root of the tooth, and which we call the cementum. It has been known for quite a while that this cementum is bone. Trials have been made to bring out differences in structure between bone and cementum, but they are so far failures. In this tissue Boedecker showed that the so-called laminae and their offshoots, the canaliculi, contain what is called protoplasm, that is, living matter, in a reticular arrangement. Dr. Boedecker was the first to show that the cementum covering the neck of the tooth is destitute of bone corpuscles and of laminate structure, but that it has peculiar spindle-shaped

formations of living matter. All these facts, which have been obtained independently of practical work, are in beautiful harmony with what we know about the sensitiveness of the teeth from practical operations upon them. The greatest pain, when you work upon a tooth, is felt when you reach the interzonal layer. Another sensitive portion is the neck of the tooth; and the reason is because these parts are supplied with so much living matter. Dr. Boedecker demonstrated that the reticular structure is present in the cementum in the same distribution as in the bone; but the finest reticulum pervading the basis-substance is not yet proved directly to contain living matter.

The fourth tissue of importance in the construction of the teeth is the pulp tissue; in this Dr. Boedecker made his latest discoveries. The pulp tissue proved to be composed throughout of myxomatous tissue, which is the first to form in the embryonal body in its earliest stages of development. It represents a jelly-like mass; and what we call the umbilical cord and the placenta are composed of myxomatous tissue. In former times it was thought that in the body of the adult there was but one place where myxomatous tissue could be found, namely, the vitreous body of the eye. To-day we know this tissue to be present in the lymphatic ganglia, or lymphatic glands, and the pulp of the teeth also. In former years I was of opinion that the pulp was myxomatous only in juvenile teeth, and that in a more advanced age the pulp becomes fibrous. Dr. Boedecker has proved that this is not quite so. The myxomatous condition is the normal physiological condition of the pulp, while the fibrous condition is the result of morbid action and inflammation of the pulp, which destroys the myxomatous tissue and replaces it with fibrous. Thus full harmony is established with other fibrous structures, and we come a step nearer to understand the formation, called pulp stones.

At the boundary of the pulp, close to the dentine, there is a row of bodies, which are medullary elements. They have been discovered by Tomes, and termed odontoblasts. Some histologists were under the impression that the odontoblasts were epithelia; but this view was disproved, and it was demonstrated that they are nothing but embryonal elements, such as are present whenever a tissue is about to change into another, as it is in the change of pulp tissue into dentine. The medullary or embryonal corpuscles are arranged in rows, and between the rows we see the dentinal fibres going down into the pulp tissue. The dentinal fibre is not in immediate connection with the

odontoblast, but rises up between the odontoblasts. This arrangement was found to be in relation to the nerves of the pulp. The medullated nerve fibres, upon approaching the periphery of the pulp, lose their medullated character and become non-medullated. The nerve fibrillae running between the odontoblasts are either directly or indirectly connected with the dentinal fibrillae, thus establishing communication from the outer part of the tooth down to its center. Tomes, Sr., suggested that perhaps the dentinal fibrillae might be nerves, and he came very near the truth. In fact, we know that formations called nerves and the dentinal fibrillae are built up on the same plan; it is only from the greater mass of living matter that certain filaments deserve the name of nerves.

As soon as we have an insight into the structure of the pulp, the forms which are partly due to senile metamorphoses are explicable. Secondary dentine, as you know, invariably forms in the outermost portion of the pulp-chamber. In advancing age, the more the tooth is worn, the more secondary dentine is formed; and the same, if caries invade the tooth. We see that irritation brings out secondary dentine. There is one law governing the formation of primary or normal dentine, and that of secondary dentine, which latter appears in three varieties: With irregular canaliculi, with lamellated basis-substance and with bone-like formations, termed osteo-dentine. Dr. Boedecker made researches on inflammation of the pulp, which brought out entirely new facts. Pulpitis, as a primary process, occurs almost invariably where there is secondary dentine. First, a gentle irritation going on, will bring about a tolerably regular formation of secondary dentine; then, the irritation becoming too severe, inflammation sets in, which again destroys the secondary dentine, in many cases necessitating surgical interference. The so-called pulp-stones have proved to be identical with secondary dentine. A mass of regular bone tissue also has been found in a pulp-stone and preserved by Dr. Boedecker.

The next tissue which was carefully examined is that surrounding the root of the tooth, which is fibrous connective tissue in connection with the tissues of the gums and the periosteum of the socket. The fibers run obliquely and suspend the tooth in its socket, giving it a certain degree of mobility, which leads to the formation of facets at the proximal surfaces. For this tissue Dr. Boedecker proposed the term pericementum, which, I think, ought to be adopted. There can be periostitis outside the socket, and how shall we distinguish it from

that within the socket if we reject the word pericementum? However, this tissue proved to be full of living matter, just as any other fibrous tissue; it is directly connected with that of the cementum, and with the Haversian canals of the bone tissue. This explains why, whenever a destruction of pericementum takes place, necrosis of the bone will result. The features of pericementitis are described by Dr. Boedecker. We may discriminate between the two varieties of plastic and suppurative pericementitis; this latter again being either a so-called pyorrhoea alveolaris or an alveolar abscess. Another process which can be understood upon the minute anatomy is the process of caries. Dr. Abbott found that in caries the enamel as well as the dentinal tissue is first deprived of its lime-salts, due to the presence of some acid, and in the next step they are reduced into their embryonal or medullary condition through the process that we are accustomed to find in every inflammatory action. While in other tissues, whose supply of blood-vessels is abundant, a reaction follows, the medullary corpuscles increase in number and bring about a new formation; in caries, which takes place in tissues destitute of blood-vessels, the medullary corpuscles do not produce anything, but become subject to disintegration and the seat of growth of leptothrix and bacteria. The inflammatory process proceeds to a certain step where it stops, and destruction of the tissue follows. The idea that leptothrix pervade the tissue ought to be abandoned; its growth is proved to be secondary to the inflammatory process of caries. Dr. Abbott accidentally met, in his studies, with a feature which is strongly in favor of Dr. Boedecker's assertion as to the presence of enamel fibrillæ. For microscopic study, enamel must be ground, but not dry, of course, on the wheel of a corundum lathe. I have examined specimens where the enamel was accidentally removed and the enamel fibres were plainly visible protruding from the specimen in so characteristic a configuration that not the least doubt could arise as to their nature.

The last point to be entered upon is the development of the teeth. It is one of the most interesting processes that we know of, and is very complicated indeed. We know that the first start of the development in the third month of embryonal life, is that the surface of the epithelium in the oral cavity sends a prolongation downward. A tooth, therefore, is epithelial in its first stage of formation, the same as all other horny formations. The teeth are transformed from the epithelial into the medullary tissue, and from that arise all other dental tissues. Especially the formation of the enamel can be understood only by

sustaining this theory of reduction. Why teeth should start as epithelial forms is a puzzle, unless we take the ground of Darwin that we find analogies in the development of the organs of animals; we find quite a number of animals which, instead of teeth, have horny epithelial formations in their oral cavities. This would indicate that the teeth originally start as epithelial forms in their lowest stage of development. From the epithelium a medullary tissue arises which becomes myxomatous, as the pulp tissue does, then breaks down into the medullary stage again, and lastly forms the enamel. Waldeyer claims that each epithelial body is calcified; while Kölliker believes that the calcified mass is a secretion of the epithelia. Neither of these assertions is correct. The truth is that the enamel is built up on the same plan as dentine, from medullary tissue—the only difference being that in the former the start is epithelial in nature. Dentine is for a long time known to originate from medullary elements. How the cementum is formed we do not know yet.

Now, gentlemen, I have had the pleasure to bring before you, in a rather brief way, the results of the researches made in my laboratory in the last four years. You perhaps may ask: What is all that good for, though I hope you will not. If you want to be scientific dentists you must know the material on which you work, every particle of it. In order to be more than a rough, empirical tooth carver, but able to think and judge about the material on which one is working all the time, it is necessary to know what I have endeavored to tell you. You cannot touch the teeth with your instruments without inciting an action on the part of these tissues, which can be beneficial if you do your work properly, and detrimental in the highest degree if you do your work without the knowledge of the anatomy of the teeth. The reaction of dentine is best observed in teeth which went through the hands of the old dentists, who thought the enamel was simply marble or crystal; they did not mind trimming it away when they found a cavity that was not easily within reach. But no such thing is admissible to-day, for it deprives the tooth of its best protecting material. Pull a tooth, but do not touch the enamel unless it is absolutely required; do not remove more than the process of caries has already destroyed. If you work without discrimination between the dentine of old and that of young persons, or between a person of feeble constitution and another who is strong, having more lime-salts, then you make a great blunder. What a number of provisional teeth are lost because the filling is too severe and causes reaction! This could be obviated, and a little protection will save the provisional teeth.

The value of our work is not immediately seen, but we know that scientific work, as such, never brings direct results. Electricity originally was nothing but an experiment in the hands of some thoughtful man, sometimes perhaps but a little play-toy, but to-day it is a very powerful and useful thing. It is very much the same with this minute anatomical knowledge. Do not look too much for practical value, but take it as something worth knowing without any further usefulness, and then this may come in many points of which we do not dream yet.

Dr. BREWSTER: I would like to have Dr. Heitzmann give us some information in regard to Nasmyth's membrane.

Dr. HEITZMANN: It is a subject I did not allude to, for the very reason that there is a discrepancy of opinion about its significance. Dr. Atkinson adheres to the original idea of Nasmyth, that it is a layer of cementum overlapping the crown of the tooth. Afterward it was found that it is epithelium, judging from all the analogies in the body, namely, that all cavities which are in direct or indirect communication with the outer world are lined with an epithelium. I think that this epithelium is nothing else than a prolongation of the epithelium of the oral cavity, which covers also the gums. I know that Dr. Atkinson does not agree with me in that, but I put it down according to my own conviction. For the study of Nasmyth's layer, we had not very good specimens of human teeth, but some excellent ones of cats, on which this point was displayed elegantly.

Dr. ATKINSON: Let my first words be of congratulation to this body that they have enjoyed such a treat as we have had set before us to-night, and which is the culmination of the work of many honest men of profound researches and of clear determination in their minds to arrive at the truth irrespective of consequences. And I would rather speak of our agreements than of our disagreements, for wherever a disagreement comes, it necessarily involves a conception of ignorance being its source on the part of one or the other of the disputants. I have strong convictions myself, and when I take a position, I hold myself open to be examined as closely as human intelligence can examine a subject, and when I set down any observation as being irrefutable, I go for it with my whole power. Where it is a matter that is more in abeyance, I am as kind as a kitten to every man's view, whatever it may be, so much so that those who hear me now will bear me out in often having said that I owe more to my pupils than to my teachers as a rule. That does not hold good in regard to the noble gentleman who has spoken to us to-night. He has been the means of explaining to

me many things that were ambiguous; and I wish to emphasize his recommendation to educate the power of vision, so that the eye will present to the tablet of the mind a truthful interpretation of what is presented. If I am moved in my affectional forces toward any set of my fellow-men who are engaged in scientific research more than toward any others, it is toward the neurologists, and especially toward the German or European investigators. They seem to have been so close in association as to be more or less a stimulus one to the other, so that they have taken up special departments, and thereby have brought out more than they could have done if they had all attempted to accomplish the same work in a general way. A careful reading of the works on histology and natural history will justify everything that we have heard to-night, and it will justify me in saying that the men who made the drawings in those works, and who knew nothing about them at all, were really honest men, for they did draw Max Schultze's thorns in the reticulum in the dentine, even as early as the work published by Professor Owen. If you will look over the representations of the human teeth in that work, you will find that they are fully represented there, and without one word of explanation in the text. Why? Because the idea had not found a lodgment in the mind of Professor Owen, or any of the noble men who assisted him. I had much of sorrow in being made acquainted with these men on my last Summer's trip, because I am impressed with the idea that most of the men who have been leaders there—I will except John Tomes—have had the real workers behind them, and they, being in government employ, have utilized the labor of their boys and given it out as their own labors; and this is proved by the fact that they have failed to explain what was actually drawn by the observers of the specimens in the drawings I have referred to. I am proud that the managers of this, my pet society, had the intelligence, during the time I was lying on my back, to ask this noble worker in the cause of science to come and give you this useful and scientific presentment of what is only lately revealed in the world of natural history. I want also to plead with you to heed his worthy, truthful, religious remarks, when he says you must understand the material with which you deal if you expect to do clean work. We had observed, in a way, many of these things, but we did not know how to explain them. There are many things still, as he has so beautifully and with child-like simplicity said, that we have not proved yet that this is living matter, but he holds out the hope, that is always a stim-

ulus to every one in search of truth in nature, that some time we may be able to get a reflecting medium better than we have yet had, so as to amplify to a greater extent these fine structures, and the truth may then be revealed. You will remember that my friend, Rufus King Brown, stated that he had spent some time trying to get objectives for the diamond. He did not succeed. It is a great pity that scientific seekers, when they have received such a revelation of truth as has been presented to us in this rich syllabus, are still not satisfied to accept it, but hold out a stimulus to make the boys go on in the old effete way.

I have often said to my pupils: If you do not beat your teachers, and your fathers and ancestors in their line, you ought to be spanked, for you have such facilities as were not vouchsafed to us. My first instructor was Professor Goadby, of London, in the year 1856, in Cleveland, Ohio; and from that day to this I have the name of always doing my utmost to get hold of the truth. I think it was an endowment from my mother—a desire to do faithfully and honestly all the work of this life. I inherited it; I do not take the credit personally at all, that I was enabled to understand better the material I was working upon because of the differentiations I saw. I read medicine generally, and I took up a specialty just because dentistry was not overloaded with so much bad precedent, and was not so overloaded with lies in the text-books as to make it necessary for a man to have a Herculean power not to be overborne by the heresies that they put forth as truth. As you love success, and the commendation of a quiet conscience, I would repeat my old advice: Go to Heitzmann and take a thorough course of instruction. Take a little, if you must, but the better way is to go and take a thorough course of instruction and get hold of these truths, so as to be able to do something better than Lester Curtis did. It occurs to me, too, how many of us are of such easy virtue as to accept a fallacy, and give it our adhesion, almost in preference to accepting the truth when it has been demonstrated to us.

Dr. MILLS: It has occurred to me that it would be an excellent idea to take these lectures of Dr. Heitzmann and put them in comparison with the statements made in some papers published in the Cosmos by a young man in Maine, Dr. Williams. He is evidently a very earnest student, although he has been somewhat obscure. If you will read the articles published last month by Dr. Williams, in regard to the Hesto Genesis of the teeth, you will find there an an-

swer from him, regarding the Nasmyth membrane, which Dr. Brewster inquires about. He takes the ground that there is a skin over the teeth. These things are interesting to read by comparison. They are all matters of interest; I know they are to me. I do not think I need say to Dr. Heitzmann that I am interested in his subject. My continued attendance at his laboratory testifies of it. The papers read by Dr. Boedecker, lately, are intensely interesting. One thing particularly interested me in this lecture very much, and that is the subject of pericementitis. It proves conclusively the claim made by Dr. Riggs, in regard to the destruction of the process by this disease, at certain stages. It has been disputed a great deal, and it is well enough for us to know the truth of the matter, and keep it in mind. For myself, I see in the treatment of this prevalent disorder a mission, and I am desirous of securing every confirmation, *especially* from acknowledged authority such as this.

On motion of Dr. MILLS, a vote of thanks to Dr. Heitzmann, for his excellent lecture, was unanimously passed.

Dr. COOKE: I would recommend the reading to this Society, in the presence of our friend, Dr. Mills, an article just published in the British *Journal of Dental Science*. It was read before one of the German societies, and treats of Piorrhea Alveolris, or Infectious Alveotitis, by Adolph Witzel, of Essen, Germany.

The next meeting of the Society will be held at the house of Dr. Wilder, 64 Fort Greene place, and the above articles will be read and discussed.

CONNECTICUT VALLEY DENTAL SOCIETY.—The semi-annual meeting of this Society, for 1882, is to be held at the Amherst House, Amherst, Mass., June 29 and 30. Rates at this hotel to dentists will be reduced to $2.00 per day. The attractions of this beautiful village are many. Among those, to strangers at the college, may be named the Indian antiquities, cabinets of geological specimens, and art gallery. Dr. Williams, of No. Vassalboro, Me., is expected to be present and contribute an essay. Prof. R. R. Andrews, of Cambridge, has promised to be present with some interesting microscopical work.

Railroad Connections.—Trains on the Fitchburg R. R., leaving Boston at 6.30 and 11.15 A. M., make close connections at Millers Falls for Amherst. Train leaving Brattleboro at 10.00 A. M., leaves

Millers Falls at 11.30 A. M. Trains on Boston and Albany R. R. at 5.00, 11.00 A. M., and 4.30 P. M. from the East, make close connection with N. L. and N. R. R. at Palmer. Parties from the South should go via Palmer, as there are but two stages daily from Northampton to Amherst—at 4.00 and 9.00 P. M.

Per order Executive Committee,

A. M. ROSS, *Sec'y.*

CHICAGO, April 5, 1882.

To the Editor of the New England Journal of Dentistry:

The annual meeting of the Chicago Dental Society was held the evening of April 4, and the following officers were elected for the ensuing year:

President—E. S. TALBOT.
1st Vice-President—FRANK H. GARDINER.
2d Vice-President—A. W. HOYT.
Recording Secretary—H. F. KIMBALL.
Corresponding Secretary—A. W. HARLAN.
Treasurer—E. D. SWAIN.
Librarian—JOS. G. REID.
Board of Directors—GEORGE H. CUSHING, J. N. CROUSE, EDMUND NOYES.

Respectfully yours,

A. W. HARLAN,
Corresponding Secretary.

MASSACHUSETTS DENTAL SOCIETY.—The seventeenth semi-annual meeting of the Massachusetts Dental Society will be held at Codman and Shurtleff Hall, 167 Tremont street, Boston, Mass., on Thursday and Friday, June 8 and 9, 1882, commencing at 11 o'clock, Thursday morning.

W. E. PAGE, *Secretary.*

The New Hampshire Dental Convention will meet on the 20th of June, 1882, at the parlors of the Phenix Hotel, Concord. Convention to be opened at 11 A. M.

BIBLIOGRAPHICAL.

CIVILIZATION IN ITS RELATION TO THE DECAY OF THE TEETH—A paper of Dr. Norman W. Kingsley, M. D., D. D. S., read before the International Medical Congress at London, August, 1881, has appeared in pamphlet form. As we printed it in our January number, we need not say that we consider it excellent.

MANUAL OF DENTAL SURGERY AND PATHOLOGY. By Alfred Coleman, L. R. C. P., etc. Thoroughly revised, and adapted to the use of American students and practitioners, by Thomas C. Stellwagen, M. A., M. D., D. D. S., professor at the Philadelphia Dental College. The book contains twenty-three chapters. Very interesting to read is the chapter on Dental Caries, though the author with almost unintelligible neglect of the fact of well observed decay on ivory-teeth, leans to the "chemico-vital" theory—a most unlucky word. The chapter on "Selection of Instruments" is added by the American author of the adaptation. This chapter contains a great number of illustrations of fine instruments from cuts of the S. S. White Manufacturing Company of Philadelphia. Some of our friends thought such a kind of advertising as a lowering of the value of the book, but it seems to us quite the contrary. The profession will be far better served by exact cuts of real existing and obtainable instruments, than by diagrammatic more or less impractical and unreal sketches of instruments, which cannot be bought anywhere. Here the reader gets clear, plain illustrations, and a source where to obtain them; it is just as proper for the S. S. White Company to get their instruments specially described and illustrated as it is for writers on microscopical investigations to describe the instruments they used and to give the address of their maker. We do not wish to be understood to say that the tools of other dental manufacturing concerns are not just as good; they may, perhaps, be better. But there can be no doubt that the use of advertising cuts in the book is as legitimate as any. Another chapter added by the American author is Chapter xii.—Fitting Artificial Crowns to Roots of Natural Teeth—a subject now quite familiar to American dentists. The chapter on Anæsthesia, though not very profound, is quite interesting and practical. Dr. Coleman thinks "Ethidene dichloride" pretty safe to use. But

what is it? We never read exactly that name before. Chemical formulæ of organic compounds can no longer be expressed safely by a word; the formula should be given, and even the constitution. Is it perhaps ethylene-dichloride $CH_2Cl.CH_2Cl$, or ethyliden-dichloride $CH_3.CHCl_2$?

OBITUARY.

At a meeting of the Chicago Dental Society, held May 2, the following preamble and resolutions were unanimously adopted:

Whereas, It has pleased the Supreme Judge of the Universe to call from among us our esteemed friend and associate, the late D. C. Hawxhurst, whose untimely decease was due to his untiring efforts in the pursuit of professional knowledge; and,

Whereas, We have been deprived of the companionship and counsel of our brother, whose ability and learning, unsullied reputation, and high sense of honor, have endeared him to the memory of his associates, it is right and proper that we should show with what feelings of deep regret and sorrow we learned of his untimely death; therefore,

Resolved, That in the early decease of Dr. D. C. Hawxhurst, our profession in general, and the Michigan State Dental and Medical Associations in particular, have lost a useful, wise and good brother.

Resolved, That his generous, manly character, and studious habits, command our admiration, and his example our earnest following.

Resolved, That to the family of the deceased we tender our heartfelt sympathy, in this their time of bereavement and mourning.

Resolved, That a copy of these resolutions be sent to the family of the deceased, to the Michigan State Dental and Medical Associations, and a copy transmitted for publication to each of the dental journals.

T. W. BROPHY,
A. W. HARLAN,
GEO. H. CUSHING,
Committee.